BIBLICAL CREATION

Journal of the Biblical Creation Society **BC19**

BIBLICAL CREATION **Volume 7/Number 19** **Spring 1985**

Journal of the Biblical Creation Society

Editorial 1
Contributors to this issue 2

All at Sea with Faith 3
by Michael B. Roberts

C.S. Lewis and Evolution 9
by David C.C. Watson

Creation needs Catastrophism 11
by Graham A. Fisher

Entropy: Fact, Speculation and Fiction 17
by Philip Duce

Book Review 28
by David Tyler

Editorial Committee

David C. Watts, PhD, BSc, MInstP, CChem, FRSC, General Editor,
Senior Lecturer in Biomaterials Science,
University of Manchester.

The Revd Nigel M. de S. Cameron, MA, BD, PhD,
Warden of Rutherford House, Edinburgh.

J.H. John Peet, PhD, CChem, FRSC,
Science Coordinator at Guildford County College of Technology.

David J. Tyler, MSc, MInstP, ACFI,
Lecturer at Manchester Polytechnic.

David S. Walton, BSc, PhD,
Marketing Manager/Technical Sales, Elex Systems Ltd, Bracknell.

Chris Darnbrough, MA, PhD,
Research Fellow in Biochemistry, University of Glasgow

Editorial: Creation and Controversy

"You cannot please everyone all of the time." Thus the editor muses to himself! But perhaps we can please some people some of the time? Even this is difficult given the complexities of the creation issue and our propensity for simple answers to complex problems. Yet we do seek to provide whatever reliable guidance we may through the forest of questions that emerge from Astrophysics to *Zinjanthropus*. Broadly speaking there are three main areas to our work. Firstly, the responsible exegesis and interpretation of the written Word of God as it bears on creation. Controversy is unavoidable even here. Secondly, the assessment of scientific facts and theories bearing on origins. We shall never, never finish this task. What we must do, however, is to inculcate in younger Christians a love for the real joy of honest scientific labour that is willing to follow God's truth wherever it may lead. Thirdly, we must seek for correlations between the teachings of Scripture and the proven findings of science. Some of these correlations will be more or less permanent, but many will be provisional and tentative. In this area, especially, there will be controversy amongst Christians and even between members of this Society. We would naturally prefer a quiet life. Failing that, we prefer open, diametrical conflict with the powers of darkness! But, so often, our duty lies in the pathway of facing controversy with our 'weaker brothers'—or our 'stronger' ones too!

Recently the *Inter-Varsity Press* have inaugurated an important and worthwhile series of books with the general title "When Christians differ". We congratulate Dr. Barclay on this series and we plan to review the volume on 'Creation and Evolution' edited by Derek Burke. The *New Testament* shows that Christians have always had to learn how to resolve conflicts and that the spirit and manner in which we proceed to resolution is as important as the resolution itself. It is a pleasure to recall and record the majority of gracious and courteous editorial correspondence received in recent years against the minority of abrasive, peremptory and abusive letters received from people who should know better.

In this issue there is some diversity of outlook reflected in the articles featured. We thank our contributors for their work and we trust that our readers will find the material stimulating. We are always pressed for space and previously there have been administrative difficulties in carrying extensive correspondence. Our Journal is now being typeset in Cheam, Surrey and printed in Manchester. In future, if readers wish to write a brief 'reaction' to the articles, then please follow these guidelines. (1) Write not more than 350 words, and (2) submit to the editor, typed with double spacing on one side only of A4 paper. (3) Include name and address, and identify clearly with volume and page number the article to which response is being made.

David Watts.

Contributors to this issue

Dr Philip Duce is an ICI Research Fellow in Physical Chemistry at the University of Surrey.

Graham A. Fisher is an honours graduate in Geography and Geology from the University of Keele. He is a teacher and author and is currently Head of the Religious Knowledge Department in a Merseyside comprehensive school.

The Rev. Michael Roberts, MA (Oxon), BA, Dip.Th (Dunelm) is a Geology graduate with special interests in the interaction of evangelicalism with geology and evolution. He is Vicar of St. Nathanael's Church, Walton, Liverpool.

Mr David C.C. Watson, MA, is a well-known author and lecturer who has recently returned to England from the United States and is resident in Ely, Cambridgeshire.

Cover Illustration
James Clerk Maxwell (1831-1879), evangelical Christian and arguably the greatest physicist between Newton and Einstein. Among his achievements was the statistical mechanics approach to Thermodynamics and the clarification of the concept of Entropy. (See article in this issue.)

ALL AT SEA WITH FAITH — AND HISTORY

Cupitt's broken arrows on the history of science

Michael B. Roberts

"The Sea of Faith
Was once, too, at the full, and round earth's shore
Lay like the folds of a bright girdle furl'd.
But now I only hear
It's melancholy, long, withdrawing roar,"[1]

Don Cupitt takes the title of his TV series 'The Sea of Faith' from Matthew Arnold's poem on Dover Beach, and he begins the series by reading the poem at Dover. It is an apt poem as in it Arnold speaks of his own loss or transmutation of faith. Arnold was brought up in a Christian home, his father being the Rugby Headmaster Thomas Arnold, who is often wrongly considered to be one of the first liberal theologians. Like many of his contemporaries, and perhaps especially like Darwin and Leslie Stephen, Matthew Arnold drifted from Christianity to Theism and then to Agnosticism and wrote about it in various of his books: *Literature and Dogma, Culture and Anarchy.* In the former, Arnold defined God as the 'eternal not ourselves that makes for righteousness' since to him God was an idea rather than objective. Don Cupitt with his non-objective view of God (or virtual atheism if you prefer) looks to Arnold as a precursor. As Matthew Arnold only heard the 'long withdrawing roar' of his father's certainties so does Cupitt in his 'Taking leave of God'.

In the last instalment of 'The Sea of Faith', Don Cupitt stood on a rocky shoreline saying that we had seen 'how the modern crisis of faith developed'. We had been offered a grand sweep of the history of thought. If Cupitt's history is right, then his theology may well be right. He emphasises how the scientific world view clashes with the Christian world view. Cupitt persuasively took us through the history of science but this is marred by many mistakes, of such magnitude that they ought to be called 'Bricks on Dover Beach'. To avoid dropping bricks myself I shall focus on one area only—the rise of Geology and Evolution.

But before dealing with that, what about his method? Unlike the Hebrews, Cupitt has ample straw for his bricks and constructs a series of straw men and thus presents a three decker universe with six 24-hour days for Genesis and

MGM's version for Exodus. As the only alternative is extreme liberalism then any intelligent being will choose that and reject 'traditional' Christianity!

His false dichotomy is persuasive and disturbs many Christians. Neither his straw men nor his arguments on the history of science have any validity. In the 'Historical animal' (Programme 2 and Chapter 3 of the book based on the series), Cupitt deals with the rise of Geology and our old friend Darwin. Bricks abound. Cupitt introduces us to William Smith (father of English Geology), Charles Lyell and his Uniformitarianism (in the book, Hugh Millar) and then Darwin and Huxley. Cupitt makes six mistakes in five minutes on William Smith (1769-1839)! It was ironic to see Cupitt expounding Smith's discoveries by the wrong canal. To call Smith an 'amateur' is wide of the mark as he was the first professional geologist. Cupitt portrays Smith as an isolated geologist cut off from 'the controversies then raging among geologists' and 'neither belonged to the Geological Society of London' (page 60). The first is a complete mis-statement. Smith was very familiar with the geological controversies of his day and knew most English geologists. His geological ideas were broadcast by other geologists and by himself. A claim for priority in 1818 proves his awareness of geological controversies.[2] In this Smith mentions most contemporary English geologists, and publications which use his work, from *Encyclopaedia Brittanica* to various early geologists and journals including those of the Geological Society and the *Philosophical Transactions of the Royal Society*. Smith was not invited to join the Geological Society at its formation in 1807 as initially it was a preserve for the 'landed gentry' geologists, not welcoming engineers. But that did not stop its President, Greenough, visiting Smith and picking his brains (and later his map). Neither can Smith be called 'unspeculative' (page 61) for he was speculative and the Deluge figured in his speculations, which he put into both prose and verse. Smith is representative of those who saw the Deluge as the last of several and was rounded on by Anti or Scriptural Geologists of the 1820s for limiting the creation to the last 30 feet of strata (the Diluvium—today, Glacial drift). In 1829 shortly before Lyell's great work, Smith waxed poetical—

> "Theories that have the earth eroded
> May all with safety be exploded
> For of the Deluge we have data
> Shells in plenty mark the strata
> And though we know not yet awhile
> What made them range, what made them pile
> Yet this one thing full well we know
> How to find them ordered so."[3]

Smith is part of the mainstream of early geology. Those early decades were the era of the Reverend Geologists as most geologists were Anglican clergy. Most of them considered that Noah's Flood was the last of many deluges all of which had

considerable geological effect. It was Smith and they (Kidd, Buckland, Sedgewick, the Coneybeares, the Phillips, for example) who laid the foundations of geology as the first historical science of nature.[4] Lyell in his *Principles of Geology* simply took over the historical succession of rocks as it stood and with a brilliant synthesis of ideas produced his *Principles of Geology*(1830-33).[5] Cupitt presents Lyell as an epoch-making revolutionary squeezing religious stories out of science. Though ten years earlier, most geologists saw the Flood as an important geological agent (for good scientific reasons), as the 1820s progressed the Flood diminished. Before, like Cupitt, we pit Lyell against 'religious' explanations, some of his supporters were very evangelical (e.g. the Rev. John Fleming a leader of the 1843 disruption in Scotland).[6] In the years before Darwin's *Origins* (1859) it is incorrect to present geological controversies as 'warfare' between science and religion. 'Literalists' and the man in the pew were disturbed by geology but geologists were often Christians and were encouraged by church leaders including evangelicals. Some of the greatest battles were between the Rev. W.D. Conybeare and Lyell, two very close friends.

Cupitt has adopted the "Warfare of science with theology" put forward so vividly by Andrew White last century and still today quoted by scientist and non-scientist, Christian and non-Christian alike even though historically it is discredited.[7] The actual course of events, over the rise of Geology in the first four decades of the last century, does not fit the popular idea of Christians denying scientists free thought. Reading books and journals of the day, one finds 'young earthers' and 'old earthers' rubbing shoulders and often not attacking one another. I find it ironic that evangelicals both in England—J.B. Sumner (Wilberforce's cousin) and G.S. Faber—and in Scotland—Chalmers and Fleming—were encouraging geologists, while some opposition to 'old earth' geology came from scientists such as Andrew Ure of Scotland of the Royal Institution in the 1820s, though how much of the latter is due to the influence of Michael Faraday I do not know (yet).[8] A study of Lyell and his contemporaries shows that the 'warfare' idea breaks down. Wilson's biography[9] makes this clear in his excellent relationships with both Dean Coneybeare and the Rev. J. Fleming. Often I have found that the evidence for 'warfare' is no more than banter between friends. Take, for example, this letter to Fleming from Lyell in 1835 about Buckland's *Bridgewater Treatise* on Geology: 'He told me, however, that his mode of reconciling Geology and *Genesis* in his *Bridgewater Treatise* has been approved by the Oxford professors of Divinity and Hebrew'.[10]

These were Burton and E.B. Pusey and Lyell could have added the evangelical Bishop of Llandaff (E. Copleston).[11] This quotation can be taken as antagonism and 'warfare' but Lyell was Buckland's pupil in Geology, and Fleming was a Scottish Evangelical Calvinist who shared Lyell's Uniformitarianism and objected to Buckland's Flood Geology on exegetical grounds. All were fairly friendly but there was at least a minor academic antagonism between Buckland and the

other two. I suspect as well that Lyell, a Unitarian and lover of liberal theology[12] was also having a go at Flemings's orthodoxy by taking the mick out of Buckland who was an orthodox Christian with evangelical leanings. This is, of course, far less simple than a 'warfare' view of history, but was it not Oscar Wilde who said "To every complex question, there is a simple answer—AND THAT'S WRONG!"

In his book, Cupitt gives a little diversion on Hugh Millar which is an exposition on how silly Christians can be on *Genesis* and Geology. His treatment of Millar leaves me speechless as Cupitt cannot have read any of Millar's works to write as he does. Then Cupitt comes to our friend Darwin, about whom more rubbish has been written than any other scientist. He is not inaccurate on Darwin's religious beliefs[13] but on the controversies over Evolution Cupitt leaves much to be desired. Did Darwin and his contemporaries see 'religious beliefs as being basically the same kind as scientific hypotheses'? I doubt it. Not even Samuel Wilberforce's (excellent) review of the *Origins* does that.[14] Cupitt fails to understand evolution as is shown by his statement that "he (Darwin) and T.H. Huxley always assumed that Natural Selection and Special Creation by God were the two rival hypotheses..." (page 66). Neither did that. Cupitt falls into the common error of equating Natural Selection and Evolution. Evolution is that view which holds that life has developed over time from simple forms to the more complex—amoeba to man if you like. There are many varieties of evolution which either reject Natural Selection or relegate it to a minor position e.g. Lamarck, late 19th century Lamarckism (which gave rise to social Darwinism)[15] and various non-Darwinian views of this century. Natural Selection is seen as the main evolutionary mechanism by the Darwinians, but neither Darwin or Huxley saw it as the only mechanism. Further natural selection is not synonymous with evolution. Huxley did hold Evolution to be a rival to Creation and is the perpetrator of the dichotomy Evolution or Creation[16] but thought that Darwin over-emphasised Natural Selection. From his letters, especially to Asa Gray, Darwin could not see why Evolution disproved God as Creator. Darwin's co-discoverer, Wallace, held a mixture of Natural Selection and Special Creation for Man and the Darwinian Controversy was not the simple religion versus science that Cupitt makes out (Jim Moore in *The Darwinian Controversies* makes a useful contribution on this).

Cupitt's motives are clear. He sets up straw men of a biblical world view and then from a selective and inaccurate presentation of the rise of science seeks to show how orthodox Christianity is untenable. He adopts the popular, but discredited, 'warfare of science and religion' approach and forces viewers (and readers) to make a false choice. In one sense a hatchet job is unsatisfactory (it always is) but as with the subjects that Von Danniken deals with, Cupitt covers such a broad field that few will be competent to deal with it all. I do not know whether Cupitt is a reliable guide on Freud, Jung, Kant, Marx and Kierkegaard but I do know that

when dealing with the history of science and the rise of Biblical Criticism Cupitt is not only biassed but very inaccurate. Perhaps his theology is similarly wrong. I prefer to build my theology on a Rock, not on bricks.

References

1 Dover Beach — Matthew Arnold *Poems* (Everyman p. 226)

2 T. Sheppard — *William Smith: his maps and memoirs 1920* (and Proceedings of the Yorkshire Geological Society XIX part 3) pages 214-220.

3 Proc. Yorks. Geol. Soc. XXV 1942 part 1 page 70

4 It is difficult to give *one* reference. The following are all useful:

C.C. Gillespie	*Genesis and Geology*	Harper 1959
Roy Porter	*The making of Geology*	Cambridge 1977
N.A. Rupke	*The great chain of history*	Oxford 1983
F.C. Haber	*The age of the world from Moses to Darwin*	J. Hopkins 1959
M.J.S. Rudwick	*The meaning of fossils*	London 1972
R. Hooykaas	*The principle of uniformity*	Leiden 1963

5 L.G. Wilson — *Charles Lyell: the years to 1841* — Yale 1972
M.J.S. Rudwick — in *'Images of the earth' (British Society for the history of Science Monograph 1)* — 1979
" — *Strategy of Lyell's Principles of Geology* — (Isis LXI 1970 4-33)

6 See briefly Hooykaas 1963 page 24ff

7 Andrew White — *Warfare of science with theology* — 1896
J.W. Draper — *History of the conflict between science and religion* — 1874
It is impossible to list contemporary writings that regurgitate this view as it is taken as axiomatic even by evangelical writers. The general drift of contemporary history of science rejects it e.g. Hooykaas, Porter, Rupke, Rudwick (Note 5) and much of the Darwin 'history industry' e.g. J. Moore *Post Darwinian Controversies* page 12ff.

8 On Fleming — see Hooykaas (op cit 5).
On Sumner, Faber (and the evangelical Christian Observer) — see Rupke (op cit 5). This 'evangelical involvement' has not yet been described at length, and is frequently overlooked or ignored. In the 1810s and 1820s two of Buckland's theological mentors were leading Anglican evangelicals — Sumner and Faber. At the present time this is my own line of research.

9 Wilson (op cit 6) — look up references to Conybeare and Fleming.

10 Lyell — *Life and Letters Vols. 1 and 2* — 1881 Vol.1 p. 444

11 Copleston, Pusey and Sumner were all theologically conservative. On Burton I am ignorant.

12 In my researches I have attempted to discover scientists' religious views and how these affected their science. Lyell must be regarded as a liberal *theist* and held to that kind of faith all his life. He was particularly keen on reading liberal theology and friendly with both orthodox and liberal churchmen. His initial opposition to Darwin was on religious grounds.

13 Based on Darwin's *Autobiography* (Oxford 1983) p. 49-56. This is a delightful source document on Darwin (it ought to be compulsory reading!) but must be supplemented by a knowledge of both Darwin's religious and scientific environment.

14 See *Quarterly Review 108* 1860 p.225-264. Wilberforce was an able scientist of a progressive Creationist outlook (similar to Buckland and Millar, or Davis Young today). The popular view of Huxley trouncing Wilberforce is a product of Huxley's defective memory and is not supported by reports of the day (see J.R. Lucas *Wilberforce and Huxley* in *Historical Journal 22* 1979 p. 313-330. The Athenaeum 7th July 1860). I cannot eat mushrooms without thinking of Wilberforce, as on expounding evolution he refers to 'our unsuspected cousinship with mushrooms' and 'our fungal descent'. The Church of England could do with some Soapy Sams on its episcopal bench today.

15 P. Bowler *The eclipse of Darwinism* J. Hopkins 1983

16 Dov Osporat *Studies in the history of Biology 1978 No. 2,* p.49-52.

C.S. LEWIS and EVOLUTION

David C.C. Watson

C.S. Lewis, like the Taj Mahal, is greater than all the photographs and eulogies. Great, but not infallible. The quotation below shows, I think, how even his brilliant mind could be confused when trying to reconcile two irreconcileables — the theory of Evolution and the truth of Scripture. If I dare to criticize, it is with much diffidence, and in the spirit of the Proverb: 'faithful are the wounds of a friend.' Since he cannot defend himself, I hope his other admirers will correct me if I do him wrong.

In the essay on DOGMA AND THE UNIVERSE we find this passage:

"When a Central African convert and a Harley Street specialist both affirm that Christ rose from the dead, there is, no doubt, a very great difference between their thoughts. To one, the simple picture of a dead body getting up is sufficient; the other may think of a whole series of biochemical and even physical processes beginning to work backwards. The Doctor knows that, in his experience, they have never worked backwards; but the African knows that dead bodies don't get up and walk. Both are faced with miracle, and both know it. If both think miracle impossible, the only difference is that the Doctor will expound the impossibility in much greater detail, will give elaborate gloss on the simple statement that dead men don't walk about. If both believe, all the Doctor says will merely analyse and explicate the words 'He rose'. When the author of Genesis says that God made man in his own image, he may have pictured a vaguely corporeal God making man as a child makes a figure out of plasticine. A modern Christian philosopher may think of a process lasting from the first creation of matter to the final appearance on this planet of an organism fit to receive spiritual as well as biological life. But both mean essentially the same thing. Both are denying the same thing — the doctrine that matter by some blind power inherent in itself has produced spirituality."

First, what is the context? Lewis is trying to answer the question: *"How can an unchanging system* (Christianity) *survive the continual increase of knowledge?"* He answers by six analogies, of which five are (to my mind) valid, but the sixth is false. Here we give only Nos. 5 and 6: I shall call them A and B. Now notice: in A, both the Doctor and the African believe in an instantaneous *miracle,* i.e. something above and beyond the common experience of mankind; whereas in B we have the 'author of Genesis' (like the African) believing in an instant miracle, but 'the modern Christian philosopher' (*un*like the Doctor) believes in a *process* which (so Scientism contends) is going on before our eyes according to a fixed natural 'law' of evolution, a process therefore which cannot by any twist of language be called miraculous.

So the philosopher and the ancient author do not at all mean the same thing. The philosopher has in fact abandoned belief in the instant-miracle of Creation; for, as Lewis himself says in an earlier chapter, the essence of a miracle is SPEED. Nobody doubts that water can be turned into wine over a period of years; nobody doubts that storm winds and waves will die down, given time; nobody doubts that fig trees will wither and die eventually. But the Gospels call us to believe in One who made all these things happen *instantly* and the 'continual increase of knowledge' has added nothing to our understanding of how He did it. If this be true of miracles in the New Testament, why not of OT miracles too? It is remarkable, but often overlooked, that in Exodus 20 the creation account is linked *not* to the First Commandment stating WHO is the true God (here the modern philosopher has no problem), but to the Fourth Commandment stating HOW He made the universe — to which many Christian philosophers will not assent.

In defence of Lewis it may be said that he was writing in the 1940s when it would have been intellectual suicide for a Professor of English to disregard Darwin. Faced with the 'assured results' of modern geology, he felt he must settle for theistic evolution. However, he clearly perceived the error of those who, yielding to the specious claims of uniformitarian biology, would separate Luke 1 and 2 from chapters 3—24, classing the early chapters as 'myth' and the later as 'history'. I like to think that, had he lived another 20 years, and made a thorough study of the equally fallacious claims of uniformitarian *geology*, Lewis would have acknowledged his own similar error in trying to divide Genesis into different literary genres — when the vast majority of Hebrew scholars, ancient and modern, agree that 'the author' regarded the whole book as 'toledoth' or *history*.

CREATIONISM NEEDS CATASTROPHISM

Graham A. Fisher

If we creationists are ever to find the keys to unlock the door of Darwin's prison, we must look up to the heavens in more ways than one. It is in the evidence for catastrophism, and in particular astronomical (astro)-catastrophism[1], that I believe we will find what we are looking for — a solid scientific basis for our assertions that the Earth is young (in accordance with the six-day creation week of Genesis 1) and has been swiftly and 'catastrophically' resculptured more than once, (most dramatically in the Flood).

The crux of the matter is this — if we Creationists are successfully to challenge today's pervasive Darwinism, resting as it does on the 'uniformitarian' assumption that 'the present is the key to the past' and that therefore all the phenomena seen on Earth can be explained by today's slow processes extending over millions of years, then we need to supply a creditable alternative view. It will not be enough merely to attack today's popular evolutionary theories to demonstrate how they defy scientific laws as well as God's Word.

Something more is needed, something that can explain the walls of Jericho tumbling down, the pillar of fire, the day the Sun stood still — and the Flood. We need something that can convince the world that the catastrophes depicted in the Old Testament are neither pious allegories nor feverish fantasies of prophetical imaginations but are sober and accurate historical accounts.[2]

The Young Earth

The first and perhaps most important thing catastrophism can do for us is to provide us with a plausible 'Young Earth' Theory.

There is no agreed consensus among Creationists as to the exact age of the Earth. There is considerable debate over the genealogies in Genesis[3] and just how complete they are, but all are agreed that Adam was not created millions, or even hundreds of thousands of years ago. At best he could date between 6,000 and 10,000 years ago, so if we stick to the 6-day Genesis record, understood as 6 × 24 hours, the Earth cannot be billions of years old. Creationists therefore need a young Earth theory.

A belief in a young Earth, however, demands a consistent explanation of the geological phenomena clearly observable in the field. It is not enough to point to the probability that radio-metric dating is highly suspect and to the multitude of data extant which indicates vastly reduced time-scales but which is carefully ignored by scientists who favour uniformitariansm.[4]

The creationist must be able to build as well as destroy and the scenario he erects must be consistent with known possible mechanisms. God *could have* created the world as we see it and placed fossils and such there to entertain us with Divine mischief, but that is hardly worth considering as an option as it calls to question the nature of the One we worship. The evidence must be weighed and when it is it will be admitted that the tops of some mountains were once below the sea and that the Grand Canyon does show evidence of successive sedimentations on a vast scale. The Earth may be young, but it has been far from static!

The Record of Catastrophe

The geological record speaks clearly of a dynamic Earth, restless, aggressive and frequently violent.[6] Indeed the rocks shriek 'catastrophe' on a massive scale, making today's volcanoes seem like sparklers compared to the 'H-bombs' of the past, and today's sedimentation like gentle dew alongside the 'monsoons' of yesteryear.

This raises many problems about the 'evolution' of the Earth. The crust reveals evidence of much alteration since its genesis. Evidence such as fossilization of creatures (many now extinct), sedimentation, ice ages, vast vulcanicity, mountain building, coal, oil and gas formation and much more. The world we see and study is not the same world Adam knew.

Since creation, so much has altered that Adam would not recognise his inheritance if he could come back today, and if the young earth creationist holds that the earth is only 10,000 or so years old, then he must address himself to the mechanics of the situation. How has it come to be as it is? Geologists can describe current processes operating on the surface today and can read the record of the rocks accurately. They struggle to explain the 'words' because they interpret their observations in terms of time and forces known (or suspected) today. They operate within the parameters of the evolutionary hypothesis and whilst creationists reject their explanations they cannot ignore their findings. Geologists extrapolate back in time on the basis of their faith in 'the present (being) the key to the past' but this is more in hope than certainty.

Many Creationists who do consider these problems find themselves having to place almost all explanations of the development of the post-Edenic world solely at the door of 'The Flood'. All Creationists must accept the Flood as a literal, global event and that its effects were the major fashioning force in post-creation geology, but it is a little naïve to suggest that the Flood explains all the phenomena and solves all the problems.

The Flood

It is a common misconception to feel that the only physical cause of the Flood was forty days and nights of rain.[7] There were two other causes, separate and distinct, listed in Genesis: a) 'all the fountains of the great deep burst forth' and b) 'the windows of the heavens were opened' (Gen. 7: 11-12). 'The fountains of the great deep' bursting forth indicate massive crustal distortions with all their attendant earthquakes and volcanic eruptions and possibly accompanied by vast orogenic movements[8] 'The windows of the heavens' opening speaks of water literally pouring down from the sky, as if God had tipped a bucket over the Earth, in addition to the violent rainstorms of the forty days and nights.

The Flood was a cataclysm on a scale unique in the annals of the Earth. Incredible tidal waves swept sediments all over the globe not once but many times during these dreadful days. Volcanoes spewed forth gases, steam and liquid magma on an unprecedented scale. Lava flows covering millions of square miles and innumerable smaller extrusions were littered all over the world. Mountains were thrust up, lands were decimated, the crust was torn apart, storms blew, fires raged, tempests howled and hurricanes lashed the land. There was not just an unbelievable rainfall for under a month-and-a-half drowning all terrestial life while the Ark rode serenely above it all: on the contrary, the Ark was pounded unmercifully, it bucked, pitched and writhed, safe but not untroubled whilst the Earth broiled. Even aquatic creatures were slaughtered in vast quantities, some being fossilized in the very act of eating, and definitely being swiftly buried alive instead of dying and being allowed to fall gently to the sea bed there to be entombed, as in the standard geological explanations.

What then could have produced such effects?

Possible Mechanisms

Geologists look down for their answers but astro-catastrophists look up! They believe that the forces which have been responsible for fashioning the crust have come from space and not from within the Earth. Bodies such as small planets, large comets, meteorites and asteroids, flying directly at or near to the Earth could create such swift and massive devastations as described above.

As these bodies approached the Earth, tidal (gravitational) forces would increase tremendously, electromagnetic discharges would be evident, and impacting bodies, in addition, would produce 'nuclear' effects. The whole concept of the Earth being 'attacked' from space is gaining scientific respectability.[10] Orthodox scientists will not go beyond meteorite impact just now but they are coming to question the tenets of uniformitarianism today. Once they can accept that, then it becomes a small step to accepting that even larger celestial bodies could have

approached the Earth in the past. If they did, then the effects which geologists claim took millions of years to produce could be produced in hours, days or weeks. The door is opened for a young Earth to have been fashioned as we see it today. The Flood, for example, could have been created by a large ice satellite flying within the Earth/Moon system and melting with devastating effects.[11]

Such a scheme does not have to have been a once only event. There is room now for many lesser catastrophes in addition to the one which produced 'The Flood'.[12] They would have had more local effects, varying in intensity, yet satisfying the observable data that more than one event no matter how stupendous, affected the Earth.

The Decline of Catastrophism

A catastrophic interpretation of the world's history declined in popularity under the onslaught of uniformitarianism some 150 years ago. It was submerged because, although there was abundant evidence for it, no mechanism could be imagined which would provide a naturalistic rationale to fit the data. Christians could declare that God made or caused it, and that the Deluge was the all-embracing answer, but men wanted to know at least how the Deluge happened! There were philosophical reasons too for the rise of uniformitarianism and the decline of catastrophism but, if a catastrophic mechanism could have been postulated, the stranglehold of uniformitarian thinking might well have been avoided. As it is even today Creationists show a distinct reluctance to take on board the Catastrophist yet they must do so if they wish to retain their scientific credibility.

This reluctance is understandable because modern Catastrophism is vilified by the current scientific hierarchy and Creationists are having enough difficulties defending Creation and attacking Evolution, whilst maintaining that they do so on scientific grounds, to take up another esoteric cause. Catastrophism is still classified by many as being in the lunatic fringe camp instead of being accepted as providing a valid alternative scientifically feasible explanation of Earth history.

Modern Catastrophists do not necessarily support Creation or a 'young Earth theory' but they do demonstrate practical alternatives to the current uniformitarian views of modern scientists. It is a foolish Creationist who ignores such ideas.

What about today?

Opponents of such views point out that we do not observe catastrophes like this occurring today. Occasionally a meteorite will strike with terrifying local effects,[13] but this hardly gives cause for mankind to develop a catastrophic neurosis. If 'the

present is the key to the past' then there is no need at all to suppose that such events did occur on a global scale no matter how logical and feasible the celestial mechanics of the situation may be. This is true, but is the present the key to the past? Is making such an assumption one reason why there is a great deal of mystery about the past?[14] Is it also the reason why many people deride the Bible? Peter thinks it is (2 Pet. 3: 3-7)!

Catastrophists who accept a Clube and Napier system[15] of meteorite impact causation point out that the Solar System passed through a belt of meteorites in space some 3,000-4,000 or so years ago and they were far more common then than today. A lessening of their effects is therefore totally consistent. Proponents of the planetary hypothesis, favoured by Velikovsky[16] and Patten,[17] point out that the former eccentric orbits of certain planets, which could bring them into collision courses with the Earth from time to time, have now settled into their familiar 'safe' orbits, thereby eliminating a present day threat from that source. There is nothing scientifically inconsistent with these explanations save that they deny that 'the present is the key to the past'.

Honest hesitation

Many Creationists hesitate when it comes to catastrophism. They are uncertain about what has been called 'celestial billiards' which is a useful metaphor for describing planetary catastrophism. This hesitation is correct as there is a great deal of work to be done on any theory of catastrophism and the current ones may well have to be modified in the light of future discoveries and research. There is no need to nail one's flag to the mast of any single theory of catastrophism at the moment but to keep an honest open mind on the subject and explore the various possibilities.

What is important is that Creationists recognise that in the Catastrophist they have an ally not an enemy. They may not like all that he does and says for he may not be preaching the "full gospel".

Like Apollos of old he may need a Priscilla and an Aquila to teach him 'the way of God more accurately' (Acts 18: 24-28), but once he learnt, Apollos became one of the most eloquent and powerful apologists in the first century church.

Catastrophism and the Christian

Catastrophism should commend itself to all lovers of God's Word because it is a theory consistent with it. It allows for a young Earth, for the veracity of the record of the Scriptures (especially the Old Testament): it reflects the truth of the New and shatters the complacency of those who would bask in the apparent safety of a uniformitarian world.[18] Above all it teaches that the world could end

tomorrow, and whilst there is no need to be neurotic about it there is every need to be alert spiritually and be ready should it come. The Bible too is opened up in exciting ways once catastrophism is appreciated,[19] and the current world view is rejected.

There is therefore no doubt at all: Creationism needs Catastrophism!

Notes

1 I am using the word 'catastrophism' to mean astro-catastrophism, i.e. catastrophism on Earth which has its origin in space according to the theories of Velikovsky, Patten and others.

2 *Speak through the Earthquake, Wind and Fire,* by G.A. Fisher, Countyvise (1982)

3 *The Genesis Flood* Whitcomb and Morris, Appendix 2, pp. 474ff, Baker Book House (1961)

4 See R.L. Wysong, *The Creation-Evolution Controversy,* p. 159ff, Inquiry Press (1976)

5 Mount Everest is supposedly capped by a limestone rock which is sedimentary and formed under the sea. See *Encyclopaedia Britannica—Macropaedia Vol.6,* p. 883

6 *Earth in Upheaval,* I Velikovsky, Gollancz (1956)

7 The Bible gives the spiritual cause, namely the complete wickedness of man.

8 An 'orogeny' is a geological term for mountain building.

9 The Deccan of India and the Columbia-Snake plateau in Canada.

10 *The Cosmic Serpent,* Clube and Napier, Faber and Faber (1982)

11 *The Biblical Flood and the Ice Epoch,* D.W. Patten, Pacific Meridian Press (1966)

12 *The Long Day of Joshua and Six Other Catastrophes,* Patten, Hatch and Steinhauer, Pacific Meridian Press (1973)

13 As in Tunguska USSR earlier this century (30th June 1908)

14 For example, 'henge' monuments and their origins.

15 *The Cosmic Serpent,* op cit.

16 *Worlds in Collision,* I. Velikovsky, Gollancz (1950)

17 *The Long Day of Joshua and Six Other Catastrophes,* op. cit.

18 Current theories suggest that the world will be destroyed naturally in about 10,000,000,000 years (if man does not interfere!)

19 *Speak through the Earthquake, Wind and Fire,* op. cit.

ENTROPY: FACT, SPECULATION AND FICTION

Philip Duce

Discussion of the Second Law of Thermodynamics can be envisaged as taking place across a range of ideas betwen two extremes. At one extreme are the traditional axiomatic and statistical formulations of thermodynamics, which through modern developments now cover a wide range of phenomena. Here, quantities such as energy and entropy are defined and related in a precise mathematical way. At the other extreme are deeper and wider philosophical issues which have arisen from interpretations of, and problems within the mathematical formalisms. Most workers in the physical and biological sciences who make use of thermodynamics are generally located at the first of these extremes, and excursions towards the other are made to a greater or lesser degree as the context requires.

The purpose of this paper is to clarify certain issues arising across this spectrum. This is prompted primarily by the presence of careless statements and discussions of the Second Law of Thermodynamics in popular scientific literature, including that produced by some creationists. I concede that popularization requires a measure of simplification, but this should never lead to blatant untruth. Some aspects of the Second Law are *not* simple; hence I also wish to indicate the broad sweep of ideas surrounding the concept of entropy which occur in physics and chemistry. Many comments I shall make are general, but my overall perspective is taken from a commitment to the final authority of the Word of God in Holy Scripture, including the historicity of Genesis 1— 11.

In some places the following discussion is necessarily technical, but it is hoped that the general reader will gain some understanding of the sublety of the issues involved. For those familiar with the subject, I will be using a physical chemist's 'dialect', which, hopefully will not alienate workers in other disciplines!

1 Background and definitions

The original empirical sources of entropy were those physical phenomena which result from the conjunction of mechanical and thermal agencies. Refinement of the concept led to a systematic relation between the entropy of macroscopic objects and the measure of microscopic information regarding them. This systematic relation has been generalized far beyond the conditions of thermodynamic equilibrium (see below) first studied. Indeed, the objects entering the analysis need not now be physical objects at all, as in the developments in the fields of mathematics and information theory. However, my concern here is with the disciplines of physics and chemistry.

The ordinary subjects for physical and chemical experimentation are **systems** which may contain solids, liquids and gases. A system is a part of the world separated from the rest of the world by definite **boundaries**. The world outside the system is called the **surroundings**.

An *isolated* system is one which can exchange neither matter nor energy with its surroundings. No change occurs in the system as a result of changes in the surroundings.

A *closed* system is one for which there is no transfer of matter across the boundaries. Transfer of energy, e.g. heat, is allowed.

An *open* system is one for which transfer of matter and energy across the boundaries can take place.

Confusion can arise when some authors use the term 'closed' when they mean 'isolated'. Further confusion arises when in some cases it is not clear what is meant at all.

We define a function, U, called the *thermodynamic energy,* or *internal energy,* of the system. This includes both electromechanical and thermal energies (and electromagnetic and gravitational energies where appropriate). It is a *function of state;* if by virtue of some process, e.g. chemical reaction, the system changes its state, the change in U is independent of the path taken between the two states and also the rate at which the change takes place. This is true for other state functions, including entropy.

Extensive functions of state depend on the amount of material present in the system, e.g. volume (V). *Intensive* functions do not, e.g. temperature (T).

The First Law of thermodynamics may be written as follows:

$$dU = dq + dw \qquad \ldots\ldots\ldots\ldots\ldots (1)$$

dU = (differential) change in U of a system

dq = heat absorbed by the system

dw = work done on the system

If equation (1) were not true, then the principle of Conservation of energy (the original statement of the First Law) would be contravened, because dq and dw depend on the path taken during the change; an appropriate cycle of changes could be an unlimited source of thermodynamic energy.

We are now in a position to examine the Second Law.

2 The Second Law

a) Equilibrium thermodynamics

We envisage a closed system at constant temperature and pressure. The system is said to be in *equilibrium* with its surroundings when no spontaneous change is occurring within it. We can imagine two experiments; i) we can change one of the conditions, e.g. the pressure, acting on the system very quickly. The system is no longer in equilibrium with the surroundings and undergoes a spontaneous change. This is a *thermodynamically irreversible* process. After the pressure is altered, what goes on in the system is beyond our control. The system changes to a new equilibrium state.

ii) if we could change the pressure infinitely slowly so that at all stages system and surroundings remained in equilibrium, we could have complete control over the system. The change in the system is now a *thermodynamically reversible* change.

To characterise these changes we introduce an extensive function of state called the entropy, S (Clausius, 1850). The change in entropy, ΔS, is given by

$$\Delta S = S \text{ (state 2)} - S \text{ (state 1)} \qquad \ldots\ldots\ldots\ldots\ldots (2)$$

If the change is reversible, then

$$dS = \frac{dq}{T} \qquad \ldots\ldots\ldots\ldots\ldots (3)$$

dS = (differential) change in the entropy

dq = heat absorbed or lost by the system

T = temperature of the system.

But for a spontaneous process, then

$$dS > \frac{dq}{T} \qquad \ldots\ldots\ldots\ldots\ldots (4)$$

This identifies the condition for the direction of a spontaneous change. All natural processes fall into this category: there are no exceptions. We can rewrite (4) as

$$dS = d_eS + d_iS \qquad \ldots\ldots\ldots\ldots\ldots (5)$$

where,

$$d_eS = \frac{dq}{T}$$

(This represents communication between systems and surroundings.)

and,

d_iS is the change in entropy due to spontaneous change within the system.

Hence for a spontaneous process

$$d_iS > 0 \qquad \ldots\ldots\ldots\ldots\ldots (6)$$

(The Carnot-Clausius inequality)

Note that if d_eS is sufficiently negative, then the overall entropy change dS can be negative. The entropy of the closed system could decrease. It can be shown [1] that if the closed system and its surroundings are taken together as an isolated system, then the overall change in entropy for this larger system is always positive i.e. an increase. But this is not true for the closed system considered on its own.

Combining the First and Second Laws, it can be shown that spontaneous changes in a direction determined by an increase in entropy occur only for isolated systems (constant U and V). Possible implications of this fact are discussed in section 4.

We could envisage a closed system held at constant S and V [2]. It can be shown that in this case, all spontaneous processes operate to lower the thermodynamic energy U, i.e.

$$dU < 0 \qquad \ldots\ldots\ldots\ldots\ldots (7)$$

U plays the rôle of a *potential function*. Again the result is obtained by combining the First and Second Laws.

For spontaneous changes taking place in closed systems at, say, constant T and V, or constant T and P (pressure), there will be a compromise between the tendencies to minimise U and maximise S. Definition of appropriate state functions leads to the conditions for spontaneous change in these cases:

Fixed T and P: $dG < 0$ $\qquad dG = -Td_iS$

G - Gibbs free energy $\qquad \ldots\ldots\ldots\ldots\ldots (8)$

Fixed T and V: $dF < 0$ $\qquad dF = -Td_iS$

F - Helmholtz function $\qquad \ldots\ldots\ldots\ldots\ldots (9)$

U and S are hidden within these functions.

For all the closed systems described here, equilibrium is established when the potential function reaches a minimum. For the isolated system, equilibrium is established when the entropy reaches a maximum.

Hopefully this brief survey has shown that care must be taken as to what sort of system and which entropy change are under consideration. For all cases, the quantity d_iS is positive for a spontaneous change. But dS for the system (equation 5) may be positive, negative or zero depending on the conditions and constraints. These affect the value of the quantity d_eS.

The above discussion concerns changes between equilibrium states, which have clearly defined values of their thermodynamic variables—hence the heading 'equilibrium thermodynamics'. We need to extend the discussion to non-equilibrium states.

b) Non-equilibrium thermodynamics.

In order to define and analyse the entropy of non-equilibrium states we have recourse to the general theory of irreversible processes (3,4). The thermodynamic processes dealt with by this theory are those which take place when the systems are close to equilibrium. The mathematical elements which enter the theory are linear equations relating various flow quantities (J) with the (Non-Newtonian) force variables (X) that give rise to these flows. These equations formulate phemomenological laws which are the domain of *linear thermodynamics* The concept of entropy is extended to include the idea of its production in time, its density and its directed flow. For open as well as closed systems the following relations apply:

$$\sigma > 0 \qquad \ldots\ldots\ldots\ldots (10)$$

$$\sum_k J_k X_k = \frac{d_iS}{dt} = \int_v \sigma dv > 0$$

where σ is the entropy production per unit volume per second.

Equation (5) above is also valid for open systems.

Time-invariant states of open systems are not equilibrium states but *stationary states*. Here, the rate of entropy production is the *minimum* consistent with the external constraints imposed upon the system. Examples of the phenomena treated by this theory are chemical reaction, heat conduction, binary diffusion and electrical conductance.

(c) Dissipative structures

Linear non-equilibrium thermodynamics essentially deals with modified equilibrium structures. The analysis can be extended to situations further away from equilibrium which can still be characterised in terms of thermodynamic variables.

These situations mainly involve chemical reactions. A chemically reacting mixture is described by non-linear equations having, in general, more than one solution, even accounting for initial and boundary conditions. Close to equilibrium, these non-linear equations can be shown to be compatible with the linear phenomenological laws mentioned in the previous section.

In the case of equilibrium conditions the domain of solutions to the non-linear equations is called the *thermodynamic branch*. If we now vary the constraints so as to force the system away from equilibrium, non-equilibrium thermodynamics gives us a condition for the stability of this thermodynamic branch ('stability' in this context has a precise mathematical meaning). This condition can be violated in non-linear systems driven far from equilibrium. In an open system this will result in deviations from the branch of steady states which is the extrapolation of the close to equilibrium behaviour; the thermodynamic branch becomes unstable. Beyond this instabilty, new structures can appear which are radically different from the structures studied in 'classical thermodynamics'. These supercritical phenomena belong to the class of 'dissipative structures' which have been defined by Ilya Prigogine [5] as spatially or temporally organised states which are maintained only by a sufficient flow of energy and matter from the outside world i.e. ultimately by the dissipation arising from the irreversible processes occurring in the system. Under certain conditions, dissipation can become an organising factor. The Second Law is not contravened because the system is not operating in a cycle.

In far-from-equilibrium situations, a more general form of the theorem of minimum entropy production applies called the *general evolution criterion* [5]. Creationists should not be afraid of the word 'evolution' in this context; here it simply means 'how a system develops in time and space'.

It is at this level that thermodynamics can be applied to such areas as cellular biochemistry, and, with appropriate modifications, to the study of dynamic equilibria in ecosystems. The application to 'how life has originated on earth' will be examined briefly in section 6.

3 Statistical formulation of entropy

The concept of entropy introduced historically by Rudolph Clausius is purely a macroscopic idea. The Second Law makes no reference to any microscopic

clauses or underlying structures which ensure that the law necessarily follows. It was Ludwig Boltzmann who provided the first microscopic definition of entropy. His definition was statistical in character and was based initially on the statistical mechanical description of the molecules in a gas. The theory he used was based on the principles of probability and classical mechanics.

Boltzmann's formula defines the entropy as follows:

$$S = k \log W \qquad \ldots\ldots\ldots\ldots (11)$$

S - entropy

k - a numerical constant

W - the number of physically distinct 'microscopic states' of the system which correspond equally well to a given macroscopic state specified by known values of the thermodynamic variables.

From this formula the First and Second Laws can be derived. This formula allows an absolute determination of the value of the entropy in any given equilibrium state, and leads to a probabilistic interpretation of the Second Law. The entropy of a thermodynamic state is a monotonic function of the probability of that state. We know that $dS > 0$ for an isolated system, so the concept of entropy is consistent with the idea that the system, left to itself, tends to evolve into states of sequentially higher probability. The more probable tends to develop out of the less probable.

On average, the more probable will also occur with greater frequency than the less probable. But less probable events can and do occur. These represent an improbable departure from what can normally be expected.

The shortcomings of this statistical statement of the Second Law were exposed by Loschmidt and Poincaré, who questioned Boltzmann's derivation of irreversible behaviour from fundamentally reversible laws of mechanics. The time reversibilty of the macroscopic physical laws stands alongside the time irreversibilty of the Second Law.

It seems that the time asymmetry of the statistical treatment is embedded "a priori" in the theory by a deliberate choice of an initial condition imposed on time-symmetric probability theory [5b, 6]. Irreversibility is not 'deduced' from dynamics in Boltzmann's method, but this may be possible using a different approach.[5b].

4 Entropy and the universe

Difficulties relate to the application of the Second Law to the universe as a whole (perhaps not surprisingly!) It is clear from both everyday experience and astronomical observations that the universe is not in a state of thermodynamic equilibrium. Further discussion can only take place if assumptions are made as to what type of system the universe is, and how long it has existed. This is what Clausius did. He enlarged his conclusion concerning the entropy increase in an isolated system to apply to the universe as a whole, assuming that such an extrapolation was admissible, and produced two very much discussed sentences:

i) The energy of the universe is constant

ii) The entropy of the universe tends towards a maximum (the 'thermodynamic'-or 'heat-death').

This bold prognosis was (and is) far from the usual scientific caution. But the possibility of finding a law which made distinction between past and future in a 'scientific' way had a tremendous effect: in the nineteenth century, this prognosis was assimilated through appropriate interpretations into various prevailing philosophies. Of interest in a Christian context is the 'proof' of God's existence, first suggested by Adolf Fick (1869), which runs as follows:

'The development of the universe is one-directional and not cyclical—the latter contravenes the Second Law. The universe as a whole represents a progression towards an inexpiable heat death. But the world is not found to be in a state of thermodynamic equilibrium, so this means that it has not existed for ever but has a beginning in time. This beginning in time—the birth of the Cosmos—means a state of minimum entropy. This state could not be reached in a natural way, so the only explanation is the creation of the universe a finite time ago by God.'

This proof, as we have seen, is based on unlimited extrapolation of the entropy law for an isolated system to the universe as a whole, which is also considered to be finite. The astronomers Jeans and Eddington were adherents of the 'proof of creation', though they were more tentative with regard to their metaphysical deductions. Jeans saw the cosmos as the unwinding spring of a clock. Eddington saw 'insuperable difficulties' without a supernatural origin of the cosmos. Although a Christian will agree with this conclusion, the route to it described above is open to many questions. (This also involves issues surrounding rationalistic 'natural theology' which form a separate aspect of the discussion.) However, within the framework of the above reasoning, the classic philosophical discourse must be[7].

Ludwig Boltzmann resisted Clausius' prognosis, and put forward his fluctuation hypothesis. The universe as a whole is in a state of thermo-dynamic equilibrium,

and its entropy is constant and has reached a maximum. The present entropic state of the universe is a gigantic fluctuation from equilibrium. Heat death is only the most probable outcome from a set of possibilities.

Within the given presuppositions, there are statistical-mechanical difficulties with this view, and others have been sought. One main idea is that the world 'came into being' a finite time ago in a low entropy state, and is running out its course to equilibrium. The original state—a 'branch system'—was brought into being by the action of an appropriate cosmological process, which may involve regenerating, cyclic behaviour.

Other cosmological approaches seek to deduce the *origin* of irreversibility from models involving general relativity and the expansion of space [6]. Little agreement seems to have been reached within this main thesis; again, boundary conditions have to be imposed on time-symmetrical equations and this is a cause of dispute.

Clearly, any cosmological 'arrow of time' which represents the observed irreversibility of nature is not fully understood. The relationship between irreversibility in small systems and the very large system, if such a relationship exists at all, awaits description. Indeed, the basic nature of the time-coordinate in which the very physical laws themselves are embedded still eludes us as perhaps an ultimately undefinable mystery[8]. Many of the 'big' questions concerning the physical world, which have exercised great minds in the past, are often kept out of sight in today's 'routine' science. Do we really understand what energy is, let alone entropy?

5 The Second Law and the Fall

It is claimed by some creationists that the Second Law of Thermodynamics became operational only after the Fall of man. This stems from the popular idea of the 'world running down' being associated with Romans 8 vv20-22. In the light of the above description of the scope of the Second Law, this claim seems naïve and uninformed. Andrews [9] and Watts [10] have given related reasons for rejecting this view. It is conceivable that before the Fall the laws of physics and chemistry may have differed in some way from those which we have found to operate in the fallen world, but to single out the Second Law in the way described is inappropriate. Speculation about aspects of pre-Fall conditions, concerning which the scriptures tell us little and which are obviously inaccessible to experimentation (but not to reason, since we *are* told *some* things), should be undertaken with extreme caution, if at all.

6 Entropy and evolution

It is sometimes stated that entropy stands in opposition to biological and chemical evolution. The Second Law is a law of continuous disorganisation: structure introduced by initial conditions disappears. In biology the idea of evolution is associated with an increase in organisation: more and more complex structures emerge. Our response to this 'contradiction' will depend on how we view the Second Law and whether we believe that evolution has occurred.

The adherent of evolution (including chemical evolution) will ask—how can we resolve these opposing tendencies? His answer lies in the fact that the Second Law can be an organising principle under certain conditions. In the neighbourhood of thermodynamic equilibrium there is destruction of order; beyond the limit of the thermodynamic branch, generation of structure is a real possibility. It may be possible to describe biological structures as open physico-chemical systems operating beyond the stability of the thermodynamic branch. (Indeed, it *is* possible to treat some important known biochemical processes in this way). The laws of physics specific to chemical kinetics permit the flow of energy and matter to build and maintain functional and structural order in open systems; what would have appeared to be a tremendously improbable fluctuation, becomes the macroscopic solution to the problem.

I have no quarrel with these possibilities with regard to understanding aspects of the physical world as we find it to be now. But to appeal to them in the context of chemical and biological evolution to lend weight to the thesis that 'life can spontaneously come from non-life' is part of an extrapolation which has gone much too far. Indeed, prebiotic evolution still faces enormous difficulties with regard to the laws of physics and chemistry [11].

A Creationist may respond to the apparent opposition between entropy and evolution with the conclusion—"evolution is wrong because the Second Law is an established, universal law". This would appear to be too sweeping for the same reasons I have just mentioned; entropy production can contribute to the coherence of ordered (bio-) chemical structures. The case against evolution has appeal to other, much stronger arguments within the disciplines of physics and chemistry, let alone those which have been developed within biology, geology etc. The Second Law of thermodynamics does have a rôle to play in these discussions, but should be kept in its proper perspective, and its relationship to the key ideas of *information coding* by external intelligence should be understood [11].

Summary

I hope that throughout this paper I have shown that the Second Law of thermodynamics should be used carefully and thoughtfully. I have also hinted that

when fallen man 'does not think it worthwhile to retain the knowledge of God' he goes to great lengths in his spiritual blindness to 'explain' the world in which he finds himself, while assuming that a complete explanation is ultimately within his unaided grasp. May the knowledge we do acquire about the cosmos, be it on the very small or very large scale of its breathtaking complexity, be accompanied by wisdom and humility before its Creator and Lord.

References

[1] S. Glasstone, *Textbook of Physical Chemistry,* Macmillan & Co. Ltd, 2nd edition (1948), pp. 227-228. This is one of the few textbooks which explicitly states this.

[2] In acoustics, a system is compressed at constant entropy by a travelling sound wave, but this is a special case. {Blandamer, *Introduction to Chemical Ultrasonics,* Academic Press (1973)}. Constant S and V are the conditions in ordinary mechanics.

[3] I. Progogine, *Introduction to Thermodynamics of Irreversible Processes,* John Wiley and Sons Inc., (1967).

[4] D.G. Millar, Chem. Rev., 60, 15 (1960).

[5]a G. Nicolis and I. Progogine, *Self-organisation in non-equilibrium systems,* John Wiley and Sons Inc., (1977).

[5]b I. Progogine, *From Being to Becoming,* W.H. Freeman and Co. Ltd (1980). Supposedly an 'intermediate' text this is still incomprehensible in places! Contains his ideas on microscopic irreversibility where entropy is treated as a mathematical operator.

[6] B. Gal-Or, 'Philosophical Problems in thermodynamics', in *Entropy and Information in Science and Philosophy,* Eds. L. Kubát and J. Zeman, Elsevier (1975).

[7] W.R. Inge, *God and the Astronomers,* Longmans (1953).

[8] M. Shallis, *On Time,* Penguin (1983). A popular-level discussion of the ideas surrounding the nature of time, ranging from physics to mysticism. The bibliography is a good starting point for more detailed texts.

P.T. Landsberg (Ed.) *The Enigma of Time,* Adam Hilger Ltd (1980). This contains an interesting collection of more technical papers, though to my mind is definitely unhelpful.

[9] E.H. Andrews, *God, Science and Evolution,* Evangelical Press (1980).

[10] D.C. Watts, 'Nature's bondage and deliverance' in *Biblical Creation* 3:10 (1981).

[11] J.H.J. Peet, 'Chemical Evolution — some difficulties', in *Faith and Thought,* 109(2) (1982) p. 127.

BOOK REVIEW

Life Itself. Its origin and nature.

by Francis Crick, 1982. MacDonald & Co.

Reviewed by David J. Tyler

Francis Crick is widely known for his involvement in the discovery of the molecular structure of DNA—a breakthrough which stimulated research programmes in many fields. Deciphering the information system of living cells has been one of the most exciting developments of modern times—revolutionising genetics and biochemistry. In this popular and readable book, Crick focusses his attention on the subject of the origin of life. In view of his past work, which has earned him a share in a Nobel prize, Crick has good credentials to write on this subject. The outcome is a book which is, at the same time, radical, controversial and sad.

I. A *Radical* Assessment of 'Origin-of-life' Research

For years, the idea of a reducing atmosphere for the early earth has dominated thinking about chemical evolution. The experiments of Stanley Miller in the 1950s are often described to demonstrate that amino acids can be sythesised 'naturally'. The primeval 'oceanic soup' is widely accepted as part of the chance assembly of the first living organism. Other experiments are also well-publicised—particularly those of Fox and his colleagues who have succeeded in synthesising 'proteinoids'.

Crick is remarkably unenthusiastic about all this evidence and argument. He questions the concept of a reducing atmosphere:

> 'It used to be thought that the primitive atmosphere on the earth was quite different (from today's atmosphere)... Recently these ideas have been questioned.' (p.74)

Crick recognises that photo-dissociation of water vapour in the upper atmosphere could produce significant quantities of oxygen. Furthermore he accepts that the geological arguments for a reducing atmosphere are equivocal:

> 'It is now claimed that if *all* the available rocks of a given age are considered, then, when averaged, the evidence suggests that the atmosphere in the past was rather like what it is today.' (p.75)

The implications of any significant amounts of oxygen in the atmosphere are pointed out—the Miller experiment yield of amino acids drops to zero.

No discussion of other experimental work is provided, although it is plain that Crick is acutely conscious of the problems of chemical evolution: 'Here we face formidable problems.' (p.80). Nucleic acids are excellent for containing coded instructions and for replication—but on their own they are useless.

> 'Life, as we know it on earth, appears as a synthesis of two macromolecular systems. The proteins, because of their versatility and chemical reactivity, do all the work but are unable to replicate themselves in any simple way. The nucleic acids seem tailor-made for replication but can achieve rather little else compared with the more elaborate and better equipped proteins ...
> The problem of the origin of life would be a good deal easier to approach if there were only one family of macromolecules, capable of doing both jobs, replication and catalysis, but life as we know it employs two families. This may well be due to the fact that no macromolecule exists which could conveniently carry out both functions, because of the limitations of organic chemistry; because, that is, of the nature of things.'(p.72).

This synthesis is reminiscent of the familiar conundrum: 'Which came first—the chicken or the egg?' *If* DNA could be synthesised 'naturally', and *if* it were to contain coded instructions for making proteins without an encoding and manufacturing system—which itself requires highly complex proteins—the stored information would be of no value! It is misguided to think of DNA as a self-replicating molecule—the *cell* is the only self-replicating system we know in theory and in practice.

Crick just manages to hold on to two opposing ideas: he has confidence that the problem of chemical evolution can be solved, and yet he knows that the evidence weighs heavily against such an unlikely event. After speculating on statistical probabilities, he concludes:

> 'For this reason it is impossible for us to decide whether the origins of life here was a very rare event or one almost certain to have occurred. Even though arguments are sometimes put forward for the latter view, they seem very hollow to me ... An honest man, armed with all the knowledge available to us now, could only state that in some sense, the origin of life appears at the moment to be almost a miracle, so many are the conditions which would have had to have been satisfied to get it going. But this should not be taken to imply that there are good reasons to believe that it could *not* have started on the earth by a perfectly reasonable sequence of fairly ordinary chemical reactions.'(p. 87-88)

Crick is well aware that the extravagant claims made about chemical evolution in much popular and technical literature are unfounded. He does not go into details in this book (which probably detracts from its long-term value) but the negative evidence has clearly had a significant effect on his own thinking. His

only grounds for optimism is that there *is* life on earth, and the presupposition that it came about by natural means makes chemical evolution the only acceptable option.

II. A *Controversial* Hypthesis: Directed Panspermia.

Even if the earth once had a reducing atmosphere, and even if a primeval soup did develop, Crick is not optimistic that life would have emerged (p.107). If continuing research continues to point to chemical evolution being unlikely,

> 'then we are compelled to consider whether it might have arisen in other places in the universe where possibly, for one reason or another, conditions were more favourable.' (p.88)

Many chapters in the book are devoted to this hypothesis. Are there other planets? Could they sustain life? Could higher civilisations have evolved? Could procaryotic cells (bacteria or blue-green algae) have been sent by these civilisations to "seed" the galaxy with life? What sort of rockets could they have used? Undoubtedly, these chapters are full of speculative thought. Mrs. Crick, it is said (p.148) has voiced the criticism that Directed Panspermia is not a real theory but merely science fiction. Despite a vigorous defence, one wonders whether Crick is really convinced by his own arguments! He acknowledges that excitement with the subject motivates him to continue with the debate.

> 'Every time I write a paper on the origins of life, I swear I will never write another one, because there is too much speculation running after too few facts, though I must confess that in spite of this, the subject is so fascinating that I never seem to stick to my resolve.'(p.153)

III. A *Sad* Blindness to the marks of God's Handiwork.

The cell contains its own information system and is able to manufacture the extraordinarily complex range of enzymes necessary to catalyse chemical reactions contributing to metabolism, biosynthesis and replication. Furthermore, elaborate and interrelated control systems operate within and between cells. After describing the synthesis of proteins, Crick adds:

> 'Because it is so complicated the reader should not attempt to struggle with all the details. The important point to realise is that in spite of the genetic code being almost universal, the mechanism necessary to embody it is far too complex to have arisen in one blow.' (p.71)

And yet, *all* living cells possess such systems. The gulf between 'living' and 'non-living' is of cosmic(!) proportions! This argument is one which creationists have laboured for many years.

Life is God's creation, and those who look for a naturalistic origin for living things are chasing after the wind. God's design and handiwork are wonderfully displayed in the seemingly inexhaustible variety of life forms, and believers find their studies of biology enriched as they contemplate the mighty works of God in creation. It is sad when Crick, who is well able to appreciate design and information in living things, declares that God is 'a doubtful proposition at best' (p.25) and that 'creationists are a nuisance' (p.163). His commitment to naturalism is total. How did cells as we know them come into existence? The cell—

> 'must have evolved from something much simpler. Indeed, the major problem in understanding the origin of life is trying to guess what the simpler systems must have been.' (p.71)

Since Crick is hard-pressed to make satisfying guesses for the earth, he is willing to extend his thinking to the galaxy—where innumerable other options can be devised.

Crick's confidence in neoDarwinian evolution is unqualified. Once a self-replicating system starts, mutations and natural selection can transform it into procaryotes and eucaryotes, single-celled amd multi-celled organisms, plants, animals and men. The neoDarwinian evolutionary concensus is accepted without discussion. Following in the tradition established by other molecular biologists, genetic variation (mutations) at the molecular level proceeds directly to macroevolutionary transformations. This is their 'leap-of-faith'—the 'punctuated' theorising of evolutionary gradualists!

The chapter entitled 'Why should we care?' explains some of the religious and philosophical reasons for Crick's involvement in the debate. He welcomes evidence which removes man's sense of being 'special' or different from the material world.

'Reproducible experiments demonstrating that a rudimentary living system can evolve from a purely chemical nonliving one should strengthen our feeling of unity with nature in the broadest sense, meaning with the atoms and molecules of which all materials on the earth are made.'(p.162).

In contrast to this, Christians believe that man was created in the image of God, and this makes him unique in the universe. Though man's conscience witnesses to his being responsible to his Creator, many wish to destroy this testimony by 'reeducating' the conscience. This is godlessness and sin. (Romans 1: 18-20).

Crick acknowledges that western culture has been deeply influenced by Judeo-Christian beliefs.

> 'Now, the remarkable thing about Western civilisation, looked at in the broad sense, is that while the residue of many of these beliefs are still held

> by many people, most modern scientists do not subscribe to any of them. Instead, they have a quite different set of ideas underlying their view of life...'(p.163)

Crick complains about people who 'cling to outmoded religious beliefs' (p.164) and wonders why the theory of evolution is not more widely integrated into people's world-view. For example:

> 'It is only in the last ten years that people have recognised many implications of the idea that man is a biological animal who has evolved largely by natural selection. Even now very few professors of ethics approach their subject from this point of view ...'(p.164).

Let us make no mistake in our assessment of the situation. Evolutionists are blind to the light of God's revelation in the natural world, and they are averse to any idea of creation. To resolve tensions in their thinking, men go to extraordinary levels of speculation. Their objective is to change the world-views of others—extending the influence of evolutionary philosophy into every sphere of life. It is in this context that the creation/evolution issue MUST be understood. The advocates of atheistic humanism are moving forward—will the disciples of Christ be content to watch them?

Biblical Creation is published three times a year by the
Biblical Creation Society

President Prof. Edgar Andrews, *University of London*
Vice-Presidents Ranald Macaulay, *L'Abri*
The Revd Geoffrey Thomas, *Aberystwyth*
Prof. Verna Wright, *University of Leeds*
The Revd Dr N.M. de S. Cameron, Edinburgh

More information about the Society may be obtained from the Secretary

Editorial matter should be addressed to Dr D.C. Watts

Subscription enquiries should be addressed to the Administrative Officer, Mrs E. Reeves

Subscriptions

UK:	£3.00/£2.00*
Europe:	£3.50/£2.50*
Outside Europe—surface:	£3.50/£2.50*
Outside Europe—airmail:	£6.00/£5.00*

Single Issue—£1.00

*In each case the lower rate applies to undergraduate students, missionaries and the registered unemployed.

The dollar rate for those in North America is:
US$14 airmail
US$11 surface

Dollar cheques should, for the time being, continue to be made payable to 'Dr D. Lachman' and be sent to Dr D. Lachman

ISSN 0260-9460

Printed by Inkon Printers, Stalybridge. Tel: 061-338 3034 *Typeset by Evans Documentation Services. Tel: 01-642 5303*